ACTIVE MATERIAL BASED BODIES FOR VARYING SURFACE TEXTURE AND FRICTIONAL FORCE LEVELS

BACKGROUND

[0001] The present disclosure generally relates to methods and devices for selectively controlling and varying surface texture and/or frictional force levels on a surface.

[0002] Several devices or processes rely on the creation or elimination of a frictional force between opposing, contacting surfaces of two bodies to perform a specific function or operation. Exemplary devices having surfaces configured to produce or eliminate a frictional force include clutches, brakes (drum brakes, disc brakes, and the like), bearings, traction drives, devices that control fluid over or between surfaces, tires, mechanical seals, clamps, and the like. Many of these devices are either unable to control the frictional force level, or control the frictional force level by adjusting the speed of, or normal force exerted by, at least one of the contacting surfaces.

[0003] Moreover, friction exists at the surface of a body even without a second body in contact therewith. Fluid flow, airflow and/or drag create frictional forces over a surface, which can be increased or reduced by differences in the texture of the surface. Even further, aerodrag noise can be reduced or surface appearance changed by variances in surface texture.

[0004] Existing devices utilize actuators and motors to change relative speeds of and/or normal forces exerted by at least one of the contacting surfaces, as well as to change the frictional force levels and/or texture of a surface. For example, brake actuators can change a normal force between brake pads to change frictional force levels. Currently, aerodrag noise has been addressed on vehicle antennas by including a spiral wrap around the antenna. The change in surface texture of the antenna is effective to change the frequency of the noise generated by air flow over the surface of the antenna. However, the spiral wrap creates a permanent, rather than reversible texture for the antenna and can affect the antenna's ability to retract and deploy, as in the case of powered antennas for example.

[0005] Moreover, current devices for changing frictional force levels, however, can be expensive due to the high costs of separate actuators or motors. Further, other operational or functional requirements may not permit actuators and motors to be utilized to control frictional force levels.

[0006] Accordingly, there remains a need for improved devices and methods for varying the texture and frictional force levels of a surface.

BRIEF SUMMARY

[0007] Disclosed herein are exemplary embodiments of devices and methods for selectively controlling and varying a surface texture with an active material based body. A device for selectively controlling and varying surface texture includes a body having at least one surface, and an active material in operative communication with the at least one surface, wherein the active material is configured to undergo a change in a property upon receipt of an activation signal, wherein the change in a property is effective to change a texture of the at least one surface.

[0008] A method for selectively controlling and varying surface texture, includes providing a body having at least one surface and an active material configured to undergo a change in a property upon receipt of an activation signal, wherein the change in a property is effective to change a texture of the at least one surface, and applying the activation signal to the active material and causing the change in the property of the active material, wherein the active material is in operative communication with the at least one surface and texturing the at least one surface with the change in the property of the active material.

[0009] The above described and other features are exemplified by the following figures and detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Referring now to the Figures, which are exemplary embodiments and wherein the like elements are numbered alike:

[0011] FIG. **1** is a schematic representation of an active material based body for varying surface texture and frictional force levels showing the active material based contact body with (a) a first surface texture and (b) a second surface texture;

[0012] FIG. **2** is a schematic representation of an active material based body for varying surface texture and frictional force levels showing the active material based body with (a) a first stiffness and (b) a second stiffness;

[0013] FIG. **3** is a schematic representation of an active material based body for varying surface texture and frictional force levels showing the active material based contact body with (a) a first surface texture and (b) a second surface texture;

[0014] FIG. **4** is another schematic representation of an active material based body for varying surface texture and frictional force levels showing the active material based body with (a) a first surface texture and (b) a second surface texture; and

[0015] FIG. **5** is a schematic representation of an active material based body for varying surface texture and frictional force levels showing the active material based body surface with (a) an active material layer having a first thickness and (b) the active material layer with a second thickness.

DETAILED DESCRIPTION

[0016] Methods and devices for varying texture and controlling the frictional force of a surface are described herein. In contrast to the prior art, the methods and devices disclosed herein advantageously employ active materials to modify the texture of a surface. An active material component of the surface allows for control of the frictional force by varying the surface morphology of the active material component through a change in a property of the active material upon receipt of an activation signal. This change can be either reversible or permanent depending on the nature of the change in the active material and/or the existence of a biasing or return mechanism. The term "active material" as used herein generally refers to a material that exhibits a change in a property such as dimension, shape, orientation, shear force, elastic modulus, flexural modulus, yield strength, stiffness, and the like upon application of an activation signal. Suitable active materials include, without limitation, shape memory alloys (SMA), ferromagnetic shape memory alloys (MSMA), electroactive polymers (EAP), piezoelectric materials, magnetorheological (MR) elastomers, electrorheological (ER) elastomers, electrostrictive materials, magnetostrictive materials, and the like. Depending on the particular active material, the activation signal can take the form of, without limi-